This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{-1386}{14}}$$

The solution is Not a Real number, which is option A.

A. Not a Real number

* This is the correct option!

B. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

C. Irrational

These cannot be written as a fraction of Integers.

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{99}i$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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2. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 15 \div 2 * 20 - (9 * 18)$$

The solution is -311.000, which is option D.

A. $[-164.38, -155.38]$

-161.375, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[158.62, 165.62]$

162.625, which corresponds to not distributing addition and subtraction correctly.

C. $[-2846, -2839]$

-2844.000, which corresponds to not distributing a negative correctly.

D. $[-311, -310]$

* -311.000, which is the correct option.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(2 - 7i)(-6 - 8i)$$

The solution is $-68 + 26i$, which is option D.

A. $a \in [43, 50]$ and $b \in [57.1, 59.8]$

$44 + 58i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-13, -10]$ and $b \in [55.7, 56.3]$

$-12 + 56i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-75, -67]$ and $b \in [-27, -24]$

$-68 - 26i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-75, -67]$ and $b \in [24.2, 26.9]$

* $-68 + 26i$, which is the correct option.

E. $a \in [43, 50]$ and $b \in [-59.7, -57.9]$

$44 - 58i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-8 + 4i)(3 + 10i)$$

The solution is $-64 - 68i$, which is option E.

A. $a \in [12, 22]$ and $b \in [92, 98]$

$16 + 92i$, which corresponds to adding a minus sign in the second term.

B. $a \in [-26, -22]$ and $b \in [37, 44]$

$-24 + 40i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-66, -58]$ and $b \in [65, 73]$

$-64 + 68i$, which corresponds to adding a minus sign in both terms.

D. $a \in [12, 22]$ and $b \in [-98, -89]$

$16 - 92i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-66, -58]$ and $b \in [-74, -67]$

* $-64 - 68i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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5. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{2730}{15}} + \sqrt{110}i$$

The solution is Nonreal Complex, which is option E.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

E. Nonreal Complex

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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6. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{15}} + \sqrt{6}i$$

The solution is Pure Imaginary, which is option B.

A. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

B. Pure Imaginary

* This is the correct option!

C. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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7. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{9216}{36}}$$

The solution is Integer, which is option D.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

C. Irrational

These cannot be written as a fraction of Integers.

D. Integer

* This is the correct option!

E. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -96.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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8. Simplify the expression below and choose the interval the simplification is contained within.

$$12 - 16^2 + 8 \div 4 * 9 \div 6$$

The solution is -241.000, which is option B.

A. $[268.9, 274.3]$

271.000, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[-243.4, -239.4]$

* -241.000, this is the correct option

C. $[265.8, 270.5]$

268.037, which corresponds to two Order of Operations errors.

D. $[-248.1, -243.2]$

-243.963, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{9 - 44i}{-3 - 7i}$$

The solution is $4.84 + 3.36i$, which is option E.

A. $a \in [-7, -5]$ and $b \in [0.5, 1.5]$

$-5.78 + 1.19i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [280.5, 282]$ and $b \in [2.5, 4.5]$

$281.00 + 3.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-4.5, -2]$ and $b \in [4.5, 7.5]$

$-3.00 + 6.29i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [4, 5.5]$ and $b \in [194.5, 195.5]$

$4.84 + 195.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [4, 5.5]$ and $b \in [2.5, 4.5]$

* $4.84 + 3.36i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 - 55i}{2 - 7i}$$

The solution is $6.92 - 3.26i$, which is option A.

A. $a \in [6, 8]$ and $b \in [-5, -2.5]$

* $6.92 - 3.26i$, which is the correct option.

B. $a \in [-5.5, -3.5]$ and $b \in [7.5, 8.5]$

$-4.50 + 7.86i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [366.5, 367.5]$ and $b \in [-5, -2.5]$

$367.00 - 3.26i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-9, -6.5]$ and $b \in [-2, 1]$

$-7.60 - 0.89i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [6, 8]$ and $b \in [-174.5, -172.5]$

$6.92 - 173.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.
